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(AWGN) has been shown in the art. While this maintains a target BER, this does not optimize the data throughput which is probably a more important concern for data transmission. In Nokia's (Finland and Irving, Texas) joint "1XTREME proposal" with other companies to 3GPP2, the switching thresholds are derived from steady state throughput curves of the individual modulation schemes. This increases the throughput relative to the previous method but still is not optimal. For packet data transmission in a time-varying channel, what would be desirable is an on-line adaptive scheme that can adjust the switching thresholds dynamically to maximize the throughput.

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**Please replace the figure descriptions in the Brief Description of the Drawings with:**

Figure 1 shows a block diagram of the test system;

Figure 2 is graph showing of BER vs SNR;

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Figure 3 shows a graph of the switching thresholds that are derived from steady state throughput curves of the individual modulation schemes;

Figure 4 shows a block diagram of an automaton/environment model; and

Figure 5 shows the probability convergence curves of desired action for SNR of -1, 0, and 1 dB.

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**Please replace paragraph starting on page 5 line 2 with:**

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The present application provides for a scheme for an on-line adaptive scheme that can adjust the switching thresholds dynamically to maximize the throughput. We first set up a simulation system comprising of selectable, convolution encoded QPSK, 16QAM and 64 QAM sources, a flat Rayleigh fading channel model, coherent demodulators and soft Viterbi decoders. By means of this test bed, the effect of altering the switching thresholds on the data throughput can be revealed. It will be shown that a significant increase in throughput may be obtained by merely altering the value of one threshold. Next, an on-line adaptive learning scheme will be introduced that is capable of adaptively optimizing the switching thresholds as the data is transmitted. A key feature of this self-learning scheme is that it does not

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require a dedicated training signal, instead it utilizes the long-term throughput as the referee to train up the learning algorithm. The scheme will be demonstrated to converge to the best threshold value available that maximizes the long-term average throughput.

Please replace the paragraph starting on page 6, line 29 and continuing on next page with:

A4  
In a modulation-level-controlled adaptive modulation the key parameters are the switching thresholds that determine when to switch from one modulation scheme to another. In the present system, that employs three modulation schemes. There are three switching thresholds to be determined - from no transmission to QPSK (threshold L1), from QPSK to 16QAM (threshold L2), and from 16QAM to 64QAM (threshold L3). One approach is to set the thresholds as the SNR required to achieve a certain target BER for the specific modulation scheme under AWGN. By first plotting a set of BER vs SNR graphs as depicted in Figure 2, and then setting a target BER the switching thresholds L1, L2 and L3 may be read directly from the graph. For instance, for a target BER of 0.01, L1, L2 and L3 may be set to 1.4, 6.6 and 10.8 dB respectively as indicated by the dotted lines. This setting maintains the target BER, however it does not optimize the data throughput. Torrance and Hanzo also suggested a numerical optimization method, but it requires the throughput to be obtainable as an analytical function of the thresholds which is generally unavailable in a practical system.